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A STUDY OF THE ETCHING FIGURES OF THE HEXAGONAL-ALTERNATING TYPE OF CRYSTALS.

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Several minerals of the hexagonal-alternating type have been investigated with reference to etch figures. Traube¹ obtained distinct figures on the negative rhombohedron of the first order of diopside with KOH. These are triangular in outline, with the three sides unequal, the longest side parallel to the shorter diagonal of the rhomb face; the angle opposite this side is 120° . The figures on adjacent faces of the rhombohedron become congruent after a revolution of 120° about the c axis, but are not symmetrical and indicate, therefore, an absence of planes of symmetry in the crystal. The figures of the prism, according to Traube's description, are similar but less pointed, and, like those of the rhombohedrons, indicate no planes of symmetry. Traube also remarked the likeness which exists between the etchings on the rhombohedron 30 $\bar{3}$ 4 of willemite and those on 02 $\bar{2}$ 1 of diopside. The hexagonal-alternating symmetry of willemite has been demonstrated by Penfield² on crystals from the Merritt Mine, New Mexico, and also by means of the natural etchings occurring on those from the Sedalia Mine, Colorado. Dolomite has been given considerable attention owing to the fact that for years its true symmetry was not definitely known. Von Kobell and Haushofer,³ upon finding differently oriented figures upon the same crystal face, were unable to decide definitely the correct type of the mineral. Gaubert⁴ believed the dark iron-bearing dolomites to be tetartohedral, but considered the white varieties to be of the calcite type, a conclusion quite at variance with the form of the corrosion figures produced by H_2SO_4 and HCl. Tschermak⁵ in his investigation of dolomite, assigned the mineral to the hexagonal-alternating type, after having established its symmetry by etching with HCl and H_2SO_4 , cleavage-rhombohedral pieces being used. The HCl

¹ *Neues Jahrb. Min. Geol., Beil. Bd.*, **10**, 454, 1895-96.

² *Z. Kryst. Min.*, **23**, 73, 1894.

³ Cited by Tschermak, *Min. Petr. Mitt.*, **4**, 102, 1881.

⁴ *Z. Kryst. Min.*, **37**, 92, 1903.

⁵ *Min. Petr. Mitt.*, **4**, 102, 1881.

figures are very different from those developed on calcite by the same solvent, being triangular and asymmetrical, with the shortest side turned toward the pole of the rhombohedron; of the two other sides, one extends almost parallel to the short diagonal of the rhomb, the other is distinctly curved, turning to the right or left, as the crystal is a right or left form. The figures produced by H_2SO_4 are quite different from those previously described, being quadrilateral, with one side curved; they are much longer than broad, with one end narrower than the other. These figures also are asymmetrical, and turned in opposite directions on the right and left-handed forms. Complex dolomite crystals, like quartz, often reveal both symmetrical and asymmetrical etchings upon the same face, and, when twinned, the HCl figures resemble very closely those of calcite; but simple crystals unmistakably indicate by their etched forms the tetartohedral character of dolomite. The writer has observed asymmetrical triangular figures on black dolomite crystals from Teruel, Spain. Three forms, $10\bar{1}1$, $40\bar{4}1$, and 0001 are present, but only the steep rhombohedron revealed distinct etching.

DIOPTASE

The diopase crystals used for investigation are from the noted Russian locality, Altyn Tübe in the Kirghese Steppes. The crystals are simple in form and quite transparent. Well defined etchings were obtained by fused KOH , after about a minute's time. The figures on the prism are not triangular as described by Traube, but leaf like in form, with the two longer boundaries curved, and meeting in a point, producing a figure without planes of symmetry. (See diagram A.) A third short line extends in a diagonal direction across the face, intersecting the two curved lines. The figures are therefore bounded by two curved surfaces and one small plane. The longer axes of the figures extend parallel to the prism edges; and figures on adjacent prism faces point in opposite directions, indicating a hexagonal-alternating axis c . The second-order rhombohedron, immersed in HCl , etched more rapidly, revealing many long, slender, triangular pits extending parallel to the rhomb edges, but asymmetrical in outline; occasional figures have curved margins. (See diagram A.) A scarcity of suitable material has rendered the investigation of the diopase etch figures rather difficult, and there is a little doubt in the mind of the writer that the crystal form indicated in diagram A is $11\bar{2}0$. There is at any rate no mistake in the form of the etching itself, and it is hoped that further investigation may verify the results, which at present are not conclusive. The two forms etched conform, however, to the symmetry of the type.

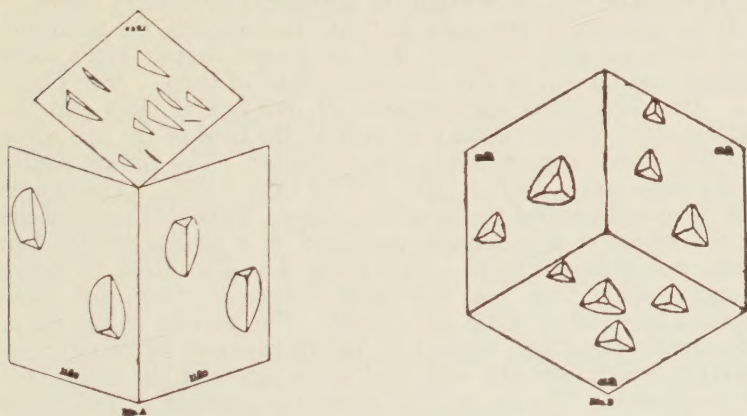
WILLEMITE

The willemite crystals investigated were obtained from Franklin Furnace, N. J. and are like those described by Palache and Gra-

ham.⁶ They are small, greenish-yellow crystals, very clear and having a fine luster. Practically all of these crystals are elongated vertically, with the prism $11\bar{2}0$ well developed. The prism $10\bar{1}0$, with few exceptions, is very narrow, and is often only a mere line. The crystals are terminated by rhombohedrons of three orders, with $31\bar{2}1$, $21\bar{3}1$, and 1011 the best developed forms. The face $21\bar{3}1$ and a cleavage plate parallel to the base were etched with several different solvents, the best results being obtained with fused KOH, and NaOH, especially when mixed. Dilute solutions of HNO_3 , H_2SO_4 , and HCl were also used, but these did not prove satisfactory, as the figures produced show but little relief and are indefinite in outline.

Rhombohedron

The etch figures in Diagram B represent those on the third-order rhombohedron, as obtained by KOH, after immersion for thirty seconds in the solvent. The figures are triangular in shape with all sides curved; two sides are a little shorter than the third, but, being equal, produce a symmetrical figure with asymmetrical



orientation. While the figures are symmetrical with regard to a plane bisecting the larger angle and the longer side, the figures are so oriented upon the face of the rhombohedron as to indicate that there are no planes of symmetry in the crystal.

Prisms

Excellent etchings were obtained on the $11\bar{2}0$ prism by the alkali fusions. Photo 1 (see frontispiece) represents the figures produced by NaOH, acting for 25 seconds. In general appearance the figures are axe-shaped, with the longer sides extending in the direction of the prism edges, and slightly divergent and curved. The narrow end of the figures is bounded by a straight line intersecting the lateral boundaries almost at right angles, and extending approx-

⁶ Z. Kryst. Min., 53, 332, 1913.

imately parallel to the intersection of the second-order rhombohedron and the second-order prism. The other extremity of the figures is bounded by a more oblique line, sometimes a little curved but usually straight, and intersects the lateral lines of the figure at an angle of 100° . Thus the form of the etch pits indicates that no planes of symmetry are possible.

The figures produced by fused KOH on the same crystal form are quite different from those previously described, and they also differ perceptibly in shape as the time of solution is prolonged. Repeated immersions of two or three seconds each gave many faint grooves extending parallel to the prism edges; after twenty seconds, these developed into well defined figures. (See Photo 2.) These etchings, although very distinct, show but little relief under high magnification; the depressions are shallow, and the lateral faces very small and the latter apparently meet the bottom of the pits perpendicularly, as illustrated in the photograph. As to general outline they are bounded by three margins, two straight, the other curved, the shorter intersecting the longer straight line at an angle of 108° , indicating the absence of symmetry planes.

If the solution be prolonged to thirty-five seconds, the resultant etch forms are quite different; they are longer, deeper, much more definite and limited by five margins instead of three. (See photo 3.) The depressions are composed of five lateral faces and the bottom; four of these slope gradually to the base of the pit, while the fifth stands approximately perpendicular. The surface angles as measured are: *a* 45° , *b* 135° , *c* 75° , *d* 135° , *e* 150° . The figures are elongated parallel to the prism edges. Repeated immersions to the extent of fifty seconds produced on a similar crystal two large, well-defined figures. (See photo 4.) This form of figure is more simple than that previously described; there are three limiting lines, all of which are curved. The bottom of the pit is now only a mere line, formed by the intersection of two curved surfaces, which form the walls and which intersect the prism face at two points. The photo also shows the position of the figure upon the prism $11\bar{2}0$; to the left of the pit the prism edge may be seen extending at an angle of 27° to the general direction of elongation of the figure. The etch figures reveal no planes of symmetry, but their position and form clearly indicate the hexagonal-alternating symmetry of the *c* axis.

Sodium and potassium hydroxides having been used separately to obtain etchings, a mixture of equal parts by weight was thoroughly fused and a small crystal immersed in this for several seconds. The figures produced are exceptionally well-defined, and are scattered over the prism face, so that they can be studied in detail. (See photo 5.) There are four boundary lines, two longer, slightly curved and extending in a direction generally parallel to the prism edges, and two shorter, cutting the longer ones obliquely, varying but 18° from the perpendicular on one end of the figure and 30° on the other. The longer faces are slightly

curved outward and meet the gently sloping planes at the ends of the figure, as is well illustrated in the photo. The surface angles as measured roughly are a 120° , b 60° , c 108° , d 72° . The figures reveal no planes of symmetry, but their position and form indicate a vertical hexagonal-alternating axis.

Other solvents used in this investigation were nitric, sulfuric, acetic and citric acids, and altho some well defined figures were produced, as illustrated in the photographs, many of them are only shallow depressions with no apparent form or direction. The best figures were obtained by the action of the weaker acids for longer periods of time; acetic and citric acids are especially desirable for etching this mineral. The other two, if used, should be very dilute; Photo 6 illustrates the etch figures produced by dilute H_2SO_4 . Upon examination these figures are seen to be entirely different from any before obtained; individual figures are rather indefinite, but taken as a group, they illustrate the asymmetrical character of the face. In detail, the pits are composed of five curved surfaces, each becoming narrower as it approaches the bottom, which is an irregular pentagon. Three of these lateral faces dip rather abruptly, the other two ascend very gradually to the surface of the crystal and fade away into a mere shadow, the intersection of which with the crystal face is barely discernible under high magnification. The intersections of the various lateral planes with one another and with the base are well shown in the photograph by the shaded lines. The angle a of the figure measures approximately 55° , and the line bisecting this angle intersects the prism edges at 45° . The figures, by their form and position, accord with the symmetry of the type. Photo 7 represents a more primitive stage of the figure just described.

The results obtained on 1120 by hot 30% acetic acid acting for two and one-half hours, may be seen in Photo 8. The figures are quadrilateral and in the mature stage are composed of four faces meeting in a point at one end of the pit. The upper margin of the mature figures is decidedly the more distinct and in all cases is a straight line taking a direction of 115° with the prism edge. The lower margin of the figures as illustrated in the photo is less distinct and uncertain and in some cases slightly curved. The primitive forms (See a and b) have little relief, but in outline are very similar to the mature figures. The figures are all elongated in the direction of the prism edges and reveal no planes of symmetry.

Photo 9 represents the etchings produced on 1170 of willemite by hot concentrated citric acid, acting for five minutes. The figures are elongated and pointed at one end, in the immature forms, but this sharp termination is gradually replaced by a short face as solution continues. The broader end of the etching is marked by a very distinct straight line which extends in a direction at 110° to the prism edges. Both lateral boundaries of the figures are curved outward, but the curvature is neither uniform nor

equivalent on both sides, consequently the figures are asymmetrical in accordance with the type.

The prism 10 $\overline{1}0$ is but slightly developed on these crystals, and being the more soluble form was beautifully etched by hot 25% HCl, acting for ten seconds. (See photo 10.) The limitations of the narrow face are readily discernible on either side of the etch figure, which extends in a diagonal direction approximately the entire width of the face. The etching is a simple oval form, pointed at either end. The inclination of the figures to the prism edges approximates 30°, therefore revealing no planes of symmetry.

Base

The base 0001 being absent on the crystals used, small cleavage pieces were etched with dilute HCl. The figures are simple triangular pits turned asymetrically to the crystal edges.

(To be concluded.)

MIRABILITE FROM THE ISLE ROYALE COPPER MINE, HOUGHTON, MICHIGAN.

ALBERT B. PECK

University of Michigan

During the fall of 1916 the Mineralogical Laboratory of the University of Michigan received from Professor A. C. Lane of Tufts College a sample of a fibrous mineral which upon investigation proved to be the rather uncommon mineral mirabilite. The material was obtained by Dr. Lane and Mr. A. H. Wohlrab, assistant to the superintendent of the Isle Royale Copper Company, from the 26th level, Shaft No. 2 of the Isle Royale Mine. Subsequently Dr. Wohlrab furnished another sample but this was from the "old workings of the No. 1 Shaft." I am greatly indebted to these gentlemen for so kindly placing this material at my disposal.

The material consists of a mass of colorless interlocking fibers, clear and transparent for the most part, and frequently very much twisted and bent. A small amount of clayey matter is present as an admixture. Upon exposure to the air, the fibers soon crumble to a white powder.

A preliminary examination before the blowpipe showed the presence of much sodium, sulfur and water, with traces of potassium, chlorine and aluminium, the last two being contained in the clayey material referred to above. Quantitative analysis yielded the result of table 1.

The mineral was first dried in an air bath at 130°C. until it showed a constant weight. This served to drive off all water. The fact that the water content, and consequently the molecular ratio, is somewhat lower than the theoretical value is easily accounted for when it is considered that the original material taken for analysis had already been partially dehydrated by exposure to air. Upon solution in water an insoluble residue of earthy

material was obtained. Sulfur was determined by precipitation with BaCl_2 and weighing as BaSO_4 . Na_2O was determined by the difference in weight of the combined chlorides of sodium and potassium: after the latter had been found as the chloro-platinate (K_2PtCl_6). The analysis and the ratios calculated therefrom establish conclusively that the substance under consideration is the mineral mirabilite ($\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$).

TABLE 1

	1	2	3	4	5
Na_2O	17.84	19.02	19.25	0.3067	0.3148
K_2O	0.72	0.77	.....	0.0081	
CaO	trace	.....	.....	.....	1.006
SO_3	23.81	25.37	24.86	0.3168	
Cl	trace	.....	.....	.....	9.677
H_2O	51.4	54.84	55.89	3.0466	
Insoluble	5.69	.....	.....	.....
	99.50	100.00	100.00		

1. Results of analysis. 2. Same, after removing insoluble matter and recalculating to 100%. 3. Theory for $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$. 4 and 5. Ratios shown by 2.

This is further confirmed by the determination of the optical constants. By using the immersion method a mean index of refraction of 1.437 ± 0.005 was obtained. This compares very favorably with the value given by Miller¹ of approximately 1.44 for β . The double refraction is very weak, low gray interference colors predominate and only the thicker sections show distinct colors. The optical character of the mineral is negative as is also its principal zone. The apparent optic angle ($2E$) is large.

It is thought that this is the first time mirabilite has been reported as occurring in Michigan. Except for its formation in large quantities in the salt lakes of the west, it is a mineral met with rather infrequently because of its great solubility and unstable character.

THE ORIGIN OF THE MIRABILITE FROM THE ISLE ROYALE MINE.

ALFRED C. LANE

Tufts College

The water of this mine, like that of all Michigan copper mines, runs very high in calcium chloride. The nearest samples analyzed to the place where the mirabilite was found give the following results, in parts per thousand.²

¹ *Trans. Cambridge Phil. Soc.*, 7, 215, 1842.

² *Mich. Geol. Biol. Survey, Publ.* 6, *Geol. Ser.* 4, II, 823.

	1	2
Cl.....	45.178	7.626
Ca.....	22.201	3.249
Na.....	3.837	1.204
Br.....	0.320	
SO ₄	0.234	
Cu.....	^a	
Sum.....	71.770	12.079
Difference.....	0.330	0.241
Total solids.....	72.100	12.320
Sp. gr.....	1.057	1.009

^a Estimated as 2 to 8 mg. per liter.

The sample is, however, somewhat nearer a fault which crosses the lode obliquely striking E and W and having 30° or less to the N and it is conceivable that a certain amount of water may circulate along this fault. These faults or crossings also contain more sulfides so that the water near them may well contain more sulfates.

The interesting thing about this occurrence of mirabilite is that while it seems to have deposited from water so high in lime, it is yet so free from lime. To explain this we may note that calcium sulfate is much less soluble than sodium sulfate, and still less so in the presence of calcium chloride. For instance at 0° C. 0.241 gram of gypsum is dissolved by 100 grams of water, and at 18°, 0.259 gram; whereas in a solution containing 15.90% calcium chloride at 25°, only 0.092 gram of gypsum is dissolved in 100 cubic centimeters.³ Calcium sulfate is more soluble in sodium chloride solutions, because sodium sulfate is formed, and this is enormously more soluble.

Unfortunately I did not observe the temperature of the mine and rock at the time we took the sample, but the normal temperature cannot be far from 15° C. (61° F.). At that temperature we find the following peculiar behavior of sodium sulfate: 37.43 grams of sodium sulfate or 105.79 grams of sodium sulfate + 7 aq. can exist away from the air, but *by exposure to air* (or the inoculation with crystals) it is converted to the sodium sulfate with 10 aq., of which only 35.96 grams (corresponding to 13.20 grams of anhydrous sodium sulfate) are soluble. *This solubility decreases markedly* with the drop in temperature, so that at 10° but 9 grams and at 0° but 5.02 are dissolved. Therefore both exposure to air and cooling would tend to promote crystallization of mirabilite more than gypsum. A study of the occurrence of this efflorescence with reference to the season and its relation to upcast and downcast currents in the mine circulation would show if temperature were the more important factor. The rock of the upper levels is down to 6° C. (43° F.) and the air temperature of the downcast shaft generally below 15° C. (60° F.).

³ *Chemiker Kalender*, Pt. I, 323 and 332, 1916.

AN ELEMENTARY INTRODUCTION TO
CRYSTALLOGRAPHY.

J. P. WINTRINGHAM.

Brooklyn, N. Y.

(Continued from page 50)

Let us take the symbol 100 and consider the position it indicates for a plane.

We know the 1 in the first place indicates that the plane passes through the near end of the axis a . The 0 in the second place indicates that it is parallel to b ; to help the memory, we may say that it would not cut the b axis no matter how far they were both prolonged, associating 0 with *not*.

In the same way the 0 in the third place means that the plane is parallel to c , the c axis. Let us assume that the axes are 1 inch or unit long from the center to the front and to the back, to the right or E, the left or W., upward or N., and down or S. Now to go back to the map, we have placed or imagined a plane say 1 inch in front of the map hanging in front of us. The symbol $\bar{1}00$, with a dash over the 1, read minus 1, 0, 0, indicates another plane in exactly the same way 1 inch back of the map. These two faces, in a way, cut out a board, and the faces are accordingly called pinacoids from the Greek for board. In the same way 010 and $0\bar{1}0$ would give two faces, or make a board, with its edge towards us standing upright. Of each of these two pairs of faces, pair by pair, it is said "they are not closed forms" because there is no limit given to their extension. If we combine the symbols 100, $\bar{1}00$, 010, $0\bar{1}0$ we would have cut out a pillar, sometimes called a second order prism, altho I think it best not to use the word prism in this way. If a crystal was of some length in this direction it would best be said to be elongated parallel to c , the third axis. Now we have four faces or planes and between them four edges, the latter all parallel. Such a set of faces are said to be in a zone. 100 indicates that the front face is parallel to c , 010 indicates that the side face is parallel to c so the line where they meet is also parallel to c or is c except that by convention we put the c axis thru the middle of the crystal. 001 and $00\bar{1}$ would indicate two more planes, one on either end of our pillar; either of these is called the base or the basal pinacoid.

By the three pairs of faces or pinacoids, our figure would now be closed. If we take the three axes as 1 inch long each way from the center and each axis at right angles to the other two, we have a cube, which every one knows. It has 6 faces, 12 edges and 8 corners. It has 3 zones, of 4 faces each, parallel to a , b or c , the first, parallel to a , taking in the four faces 010, 001, $0\bar{1}0$, and $00\bar{1}$. This would be called the a zone or the zone of the face 100; a would be called the zone axis and the 100 the zone face. The zone axis is parallel to the zone edges and the zone face is across or at right

angles to them all. If we can make out the pinacoids, we may be able to place a crystal in the conventional position by putting one of the first pair toward us, one of the second pair to the right and one of the third above.

If we take a corner where three edges meet, these three edges may be taken as the three axes. If extended beyond the corner and moved to the center without changing their direction they would be our typical axes.

The cube, with two other forms to be described and four more are classed as belonging to the Cubic or Isometric System of crystals. They are characterized by three axes at right angles and of equal length.

(*To be continued.*)

BOOK REVIEW

DIAMONDS; A STUDY OF THE FACTORS THAT GOVERN THEIR VALUE. FRANK B. WADE, of Shortridge High School, Indianapolis, Ind. G. P. Putnam's Sons, *New York*, 1916.

This little book of 150 pages is intended to furnish information to both dealer and purchaser of diamonds, as to the features of diamonds which are of influence on their market value. Chapter I is on color (spelt thruout colour), II on flaws, III on cutting or "make," IV on repairing and recutting, V on mounting, and VI on "Buying the engagement ring." The advice it contains is in every way excellent, and the presentation of the subject is so clear and so enlivened by specific cases illustrating the several points made that the book will make interesting reading to anyone even tho they do not plan to take up diamond-collecting as a hobby.

E. T. W.

NOTES AND NEWS

The collection of minerals at the Boston Society of Natural History has recently been rearranged and is now exhibited under modern conditions. The collection has been divided into two parts, one of which is entirely made up of New England minerals, the other a general collection from all over the world.

Eventually it is planned to keep only New England material with a small general synoptic collection, thus conforming to the policy adopted in other departments of the Museum.

The specimens are all exhibited on plate glass shelves without individual mounts. This method has been found to give the maximum light, and to prevent shadows; it has the additional advantage of being colorless and hence does not detract in any way from the color of the specimens.

Although the collection is very strong in New England minerals, especially those from the older localities, its curator desires to obtain specimens which will improve the present ones, and any from new or recent localities that are not as yet in the collection. For this purpose the Society is willing to exchange some of the specimens from outside of New England for particularly fine New England minerals.

EDWARD WIGGLESWORTH, *Curator*,
234 Berkeley St., Boston, Mass.

In October, 1914, the undersigned visited the locality on North Table Mountain, Colorado, described by Mr. Wilson in the March number of this magazine. Ascending to the quarry without confining myself strictly to the winding road, I found, about two thirds of the way up, a block of agatized wood about 2½ feet in diameter, projecting from the talus. In the quarry analcite, chabazite, and other zeolites, but no mesolite, were obtained.

GEORGE E. ASHBY, *Vice-President*,
N. Y. Mineralogical Club.

My classes this fall in visiting the Winter Hill slate quarries at Somerville, Mass., found some unusually fine specimens of gypsum; the pyrite cubes ½ inch on edge of those quarries are well known, and Professor Palache has described minerals from the calcite veins. When the pyrite decomposes the sulfuric acid generated seems to attack the calcite and we have on the seams, associated with limonite, a beautiful frosting of thin gypsum crystals, the individual crystals being at times nearly an inch long and over one fourth of an inch wide.

We also generally get orthite (allanite) in the pegmatites which intrude into the diorites at the Blueberry Mt. and Fessenden Road quarries of Arlington. This year I saw a lump nearly one inch across.

I have recently got from an old collection more native silver from Batopilas than I really need for my own work, and would be glad to exchange some of it.

ALFRED C. LANE,
Tufts College, Massachusetts.

SHAFTS IN GALENA-JOPLIN DISTRICT LURE COLLECTORS

The collector of minerals finds ardent dreams come true when he arrives in the Galena-Joplin district of southeastern Kansas and the adjacent parts of Missouri and Oklahoma.

In mines in the Joplin and Granby districts in Missouri and the Galena district in Kansas about forty-five different minerals have been discovered.

The mineralogically inclined visitor has little difficulty in gaining access to these mines and usually receives the best of attention from the superintendents, and is allowed to collect all the specimens he desires.

Many beautiful crystalline aggregates with two, three and even four different minerals in association can still be obtained from some of the older mines, and some of the newly opened mines near Baxter Springs, Kan., and Picher, Okla., furnish especially fine specimens of zinc ore, including parallel intergrowths of chalcopyrite and sphalerite, and galena incrustated with marcasite, etc.

The department of mineralogy at the University of Kansas has obtained many specimens of these minerals and is glad to exchange them with collectors and other universities, for minerals from other districts.—*The University Daily Kansan*, Monday, March 5, 1917.

PROCEEDINGS OF SOCIETIES

THE NEW YORK MINERALOGICAL CLUB

The regular monthly meeting of the Club for March, 1917, was held on Wednesday, the 14th inst., at the American Museum of Natural History, N. Y., at 8 P. M., with President James G. Manchester in the chair and an attendance of thirty members and nine visitors.

Mr. Otto F. Pfordte exhibited a fine series of specimens of minerals from Cobalt and Sudbury, Canada which had been intended to illustrate his paper presented at the preceding meeting but had failed to arrive in time.

The remainder of the evening was devoted to the announced address by Dr. Edgar T. Wherry of the National Museum, Washington, D. C., on "Crystal Structure."

Dr. Wherry's paper consisted of a historical sketch and detailed review of the revelations resulting originally from the suggestion by Dr. Laue of Zurich, of employing a crystal as a "space diffraction grating" for X-rays, the success-

ful realization of the idea by Messrs. Friedrich and Knipping in 1912, and its subsequent more elaborate and effective development by Messrs. W. H. and W. L. Bragg, whereby great progress has been attained on the one hand in our knowledge of the nature of X-rays, and on the other of the architecture of crystals, or the disposition within them of the various elementary atoms of which they are constructed.

Dr. Wherry's review was illustrated with blackboard formulas, adjustable models of the atomic structure of crystals, and a series of lantern slides showing the X-Ray Spectrometer and the evidence it has afforded of crystal structure by both the photographic and ionization methods, taken largely from the recent treatise on the subject by W. H. and W. L. Bragg.

At the close of the discussion which followed, Dr. Wherry gave an account of the present status and aims of the American Mineralogist which elicited the enthusiastic approval of many of those present.

WALLACE GOULD LEVISON, *Secretary*.

THE PHILADELPHIA MINERALOGICAL SOCIETY

Wagner Free Institute of Science, March 8, 1917.

A joint meeting of the Philadelphia Mineralogical Society and the Wagner Institute Society of Chemistry and Physics was held on the above date with President Trudell in the chair, 16 members and 30 visitors being present.

Dr. Edgar T. Wherry presented a lecture on "Crystal Structure." The earlier views of the structure of substances were presented introductory to the present theories as developed by the study of crystals with the X-ray spectrometer. The lecture was illustrated with lantern slides, space models and motion pictures.

Dr. Herman Burgin, Philadelphia, and Mr. Morton L. Jandorf of York, Pa. were nominated for active membership.

FIELD TRIPS

SATURDAY, MAY 19. Trip to Frankford localities. Meet at Frankford Ave. and Church Street at 1.45 P. M.

WEDNESDAY (MEMORIAL DAY) MAY 30. Unionville, Beryl Hill, and the Poor House Quarry. Meet at 69th St. Terminal at 7.15 A. M.

SATURDAY, JUNE 9. West Philadelphia localities. Meet at Broad St. Station, Subway entrance, at 1.45 P. M.

SAMUEL G. GORDON, *Secretary*.

THE MINERALOGICAL SOCIETY OF GREAT BRITAIN

London, January 16, 1917. Mr. W. BARLOW, president, in the chair.

A. HOLMES AND DR. H. F. HARWOOD: *The basalts of Iceland, Faroe Islands, and Jan Mayen*. PROF. H. HILTON: *The use of orthographic projection in crystallography*. J. V. SAMOJLOFF: *Paleophysiology, the organic origin of some minerals occurring in sedimentary rocks*. E. S. SIMPSON: *Tapiolite in the Pilbara Goldfield, Western Australia*. The mineral, which was discovered at Tabba-Tabba Creek and Green's Well, lying in a large area of granite intersected by pegmatite veins and greenstone dikes and bosses, occurs in fairly well defined crystals, which analysis proved to contain little niobium (columbium). At the first locality the crystals displayed the forms 100, 001, 111, 101, 320, and were twinned as usual on 101, and often distorted; while at the second they displayed the forms 100, 111, 101, 320, and showed twinning about 106 and 301, as well as 101. A curve was prepared showing the specific gravity obtaining in the tetragonal isomorphous series of metatantalates and metacolumbates of iron, manganese and calcium.—*Nature*, **98**, 423, 1917.

NEW MINERALS

Magnesioludwigite

B. S. BUTLER AND W. T. SCHALLER, of the U. S. Geological Survey: *Magnesioludwigite, a new mineral*. *J. Wash. Acad. Sci.*, **7**, (2), 29-31, 1917.

Ludwigite occurs in the Big and Little Cottonwood districts, Utah, as a replacement of limestone at or near the contact with intrusive rocks, associated with magnetite, forsterite, garnet, diopside, muscovite, and sulfides of

copper and iron. The ludwigite forms radial and spherulitic groups of finely fibrous crystals, and isolated crystals and groups of crystals in metamorphosed limestone. It is mostly dull greenish black, but at Mountain Lake an ivy-green type was found, for which the name *magnesioludwigite* is proposed. Analysis showed only 2.55% ferrous oxide, and it has a duller luster, lighter color, weaker pleochroism and absorption, and greater translucency than the iron-rich ludwigite from Hungary. The formula for the principal constituent of the new mineral is $\text{MgO} \cdot \text{Fe}_2\text{O}_3 \cdot 3\text{MgO} \cdot \text{B}_2\text{O}_3$, only about 15% of the corresponding ferrous compound *ferroludwigite* being present. These names are derived by using ludwigite as a group name—like feldspar, mica, etc.—and indicating end-members by chemical prefixes. S. G. G.

ABSTRACTS OF MINERALOGIC LITERATURE

THE GENESIS OF ASBESTOS AND ASBESTIFORM MINERALS. STEPHEN TABER, of the Univ. S. Car. *Bull. Am. Inst. Mining Eng.* **1916**, 1973-1998; THE ORIGIN OF VEINS OF THE ASBESTIFORM MINERALS. *Idem. Proc. Nat. Acad. Sci.* **2**, 659, 1916.

The author's conclusions are: Fibrous minerals usually occur in cross-fiber veins. Such veins are formed through a process of lateral secretion, the growing veins making room for themselves by pushing apart the enclosing walls. The veins occur in all positions. The fibers are usually normal to the vein-walls because the latter have been forced directly apart, but when the walls have had also a lateral displacement because of the simultaneous growth of adjacent non-parallel veins or other causes the fibers grow in the direction of the resultant motion. The fibrous structure is to be attributed largely to the mechanical limitation of crystal growth through the addition [accretion] of new material only in one direction. In the case of asbestiform minerals the fibrous structure is accentuated by a normal prismatic habit and cleavage."

W. G. L.

THE FLIGHT OF A METEORITE. Story of stone and iron meteors through the air, their direction and impact upon the earth. Explanation of the trail of fire of a "shooting star." ELIHU THOMSON. *Am. Mus. J.*, **17** (1) 24-28, 1917.

COLLECTIONS OF METEORITES IN THE AMERICAN MUSEUM. CHESTER A. REEDS. *Am. Mus. J.*, **17** (1) 28-31, 1917.

GEM MINING IN THE UNITED STATES; TOURMALINE AND TURQUOIS. L. P. GRATACAP, American Museum of Natural History. *Am. Mus. J.*, **17**, (1), 64-69, 1917.

THE COMPOSITION OF APATITES. F. ZAMBONINI. *Compt. rend.*, **162**, 919-921, 1916.

A large number of double salts with the general formula of the apatite group can be prepared artificially. The properties of several of these are described.

E. T. W.

CONTRIBUTION TO THE MINERALOGY OF MADAGASCAR. H. UNGEMACH. *Bull. soc. franc. min.*, **39** (1), 5-38, 1916. Abstract by P. A. v. d. Meulen, reprinted by permission from *Chemical Abstracts*, **10**, 2449, 1916.

U. describes the occurrence on the island of Madagascar of bismuth, gold, pyrite, rutile, strüverite, corundum, hematite, parisite(?), barite, monazite, betafite, cuxenite, ampingabeite, columbite, tourmaline, diopside, augite, beryl, orthoclase, microcline, and chevkinite ("tscheffkinite"). In many cases a crystallographic description is included.

CALOMEL CRYSTALS WITH UNUSUAL HABIT. G. CESARO. *Bull. soc. franc. min.* **39**, (1), 70-73, 1916. Abstract by P. A. v. d. Meulen, reprinted by permission from *Chemical Abstracts*, **10**, 2450, 1916.

The crystals are in plates parallel to the prism 100.

THE CHEMICAL PROCESS INVOLVED IN THE FORMATION OF DIPYRE (MIZZONITE) FROM THE PLAGIOCLASE OF THE OPHITES OF THE PYRENEES. A. LACROIX. *Bull. soc. franc. min.* **39**, (1), 74-77, 1916. Abstract by P. A. v. d. Meulen, reprinted by permission from *Chemical Abstracts*, **10**, 2450, 1916.

The formation of dipyre from plagioclase involves nothing but a molecular rearrangement, together with the fixation of the necessary amount of sodium chloride. The process is a surface phenomenon, brought about by saline waters.

THE OCCURRENCE OF VICINAL FACES ON IDOCRASE (VESUVIANITE) FROM ALA. FERDINAND GONNARD. *Bull. soc. franc. min.* **39**, (1), 65-69, 1916.

A crystallographic description.

A NEW MINERAL, BAZZITE. P. GAUBERT. *Bull. soc. franc. min.* **39**, (1), 63-64, 1916.

Abstract of the announcement of this mineral by Aitini (see *App. III*, *Dana's System of Mineralogy*, p. 12, 1915.)

THE PRESENCE OF NICKEL IN NATIVE PLATINUM. S. PINA DE RUBIES. *Arch. sci. phys. nat.*, **41**, 475-478, 1916.

Specimens of platinum from 10 localities yielded the arc spectrum of nickel. The amount of this element seems to be proportional to that of iron.

E. T. W.

FETID DOLOMITE FROM MARZHELAN. N. SHADLUN. *Bull. acad. sci. Petrograd*, **1916**, 417-422. Abstract by H. M. Gordin, reprinted by permission from *Chemical Abstracts*, **10**, 2566, 1916.

Analysis of samples of fetid dolomite from Marzhelan showed them to be ordinary $\text{CaMg}(\text{CO}_3)_2$ containing some sulfides, probably of Ca, Mg, and Fe. The mineral may also contain some adsorbed H_2S .

CALCITE, QUARTZ AND PROCHLORITE FROM THE CAUCASUS. L. L. IVÁNOV. *Bull. acad. sci. Petrograd*, **1916**, 621-632. Abstract by H. M. Gordin, reprinted by permission from *Chemical Abstracts*, **10**, 2566, 1916.

Descriptions and analyses of samples of calcite, rock crystal and prochlorite found in the Caucasus. An examination of the thermal curve of the prochlorite showed that the latter gives off almost all of its H_2O at 650° . The formula of prochlorite was found to be $3\text{H}_2\text{O} \cdot 2\text{FeO} \cdot \text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$.

ON THE IDENTITY OF HAMLINITE WITH GOYAZITE. W. T. SCHALLER, U. S. Geological Survey. *Am. J. Sci.*, [4], **43**, (2), 163-164, 1917.

The properties of goyazite and hamlinite are tabulated to show their similarities and their practical identity; Farrington's data are shown to be in part erroneous.

S. G. G.

ON THE ETCHING FIGURES OF BERYL. ARTHUR P. HONESS, Princeton University. *Am. J. Sci.*, [4], **43**, (3), 223-236, 1917.

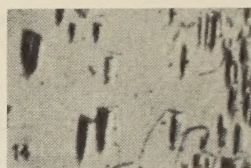
"This paper embodies a brief discussion of the etch figures of beryl, both artificial and natural."

S. G. G.

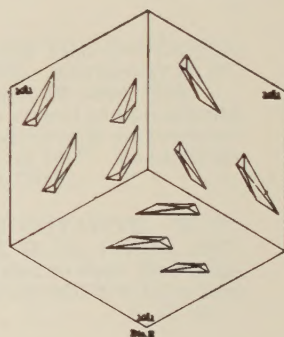
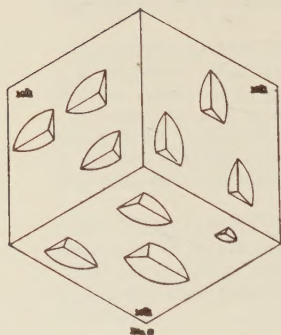
A DECIMAL GROUPING OF THE PLAGIOCLASES. F. C. CALKINS, U. S. Geological Survey. *J. Geol.*, **25**, [2], 157-159, 1917.

The grouping of the soda-lime feldspars by various writers is tabulated, and a new plan is proposed, with the divisions, starting from the albite end of the series, at exactly 0, 10, 30, 50, 70 and 90% albite for the minerals albite, oligoclase, andesine, labradorite, bytownite and anorthite respectively.

S. G. G.



Photographs by Arthur P. Honess.



ETCHING FIGURES ON DOLOMITE AND PHENACITE

For explanation see pages 71-74

Fig. 11 is x850; 12, x120; and 13 and 14, x300

PLATE II